

REMARKS

Claims 1-20 are all the claims presently pending in the application. Claims 1-3, 5-6, and 9-11 have been amended to more clearly define the invention and new claims 12-20 have been added. Claims 1, 19 and 20 are independent.

Claims 5 and 9-11 stand rejected under 35 U.S.C. § 112, second paragraph. Claims 1, 2, 4, 5, 7, 9, and 11 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Hasegawa et al. (U.S. Patent No. 5,972,539). Claims 3, 6, 8, and 10 stand rejected under 35 U.S.C. § 102(e) as being anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as being unpatentable over Hasegawa et al.

These rejections are respectfully traversed in the following discussion.

I. THE CLAIMED INVENTION

Applicant's invention (as recited, for example, in claim 1) is directed to a lithium battery which includes a power-generating element including a positive electrode, a negative electrode and a separator. Further, at least a part of the power-generating element includes a gel electrolyte comprising at least a polymer and a liquid electrolyte.

As explained in the Application, conventional lithium batteries may include a low amount of a lithium salt (Application at page 3, lines 10-20). However, such batteries show a slow diffusion of lithium ions during a high rate discharge, making it difficult to keep the battery performance at a sufficient level (Application at page 3, line 21-page 4, line 1).

In the claimed invention, on the other hand, the concentration of lithium salt in the liquid electrolyte is greater than 2 to 4 mols per ℓ of the liquid electrolyte. This allows the inventive battery to provide a better (e.g., high rate) discharge capacity performance than conventional batteries.

II. THE 35 USC §112, SECOND PARAGRAPH REJECTION

Claims 5 and 9-11 stand rejected under 35 U.S.C. §112, second paragraph. Applicant submits, however, that these claims have been amended to address this rejection.

Specifically, claims 5 and 9-11 have been amended to recite "*said liquid electrolyte comprises an organic solvent comprising γ -butyrolactone in an amount of not smaller than 50% by weight*".

In view of the foregoing, the Examiner is respectfully requested to withdraw this rejection.

III. THE HASEGAWA REFERENCE

The Examiner alleges that Hasegawa teaches the claimed invention of claims 1, 2, 4, 5, 7, 9 and 11, and makes obvious the claimed invention of claims 3, 6, 8 and 10. Applicant submits, however, that there are elements of the claimed invention which are neither taught nor suggested by Hasegawa.

Hasegawa discloses a flame retardant solid electrolyte which includes an ion conductive polymer matrix having moieties capable of imparting flame retardance to the polymer matrix and ether bonds in the molecule and an electrolyte salt dispersed in the polymer matrix. The flame retardant solid electrolyte may be one which comprises a non-ion-conductive polymer matrix and a liquid electrolyte consisting of an electrolyte salt dissolved in a solvent therefor, which is dispersed in the polymer matrix. The liquid electrolyte has a concentration of 0.5 to 2 moles/liter (Hasegawa at col. 9, lines 38-39). Further, the flame retardance-imparting moieties are derived from halogen or phosphorus-bearing compounds (Hasegawa at Abstract).

Applicant submits, however, that Hasegawa does not teach or suggest “*wherein a concentration of lithium salt in said liquid electrolyte is from greater than 2 to 4 mols per ℓ of the liquid electrolyte*” as recited, for example, in claim 1. As noted above, conventional lithium batteries may include a low amount of a lithium salt. However, such batteries show a slow diffusion of lithium ions during a high rate discharge, making it difficult to keep the battery performance at a sufficient level (e.g., Application at page 3, line 21-page 4, line 1).

The claimed invention, on the other hand, includes a concentration of lithium salt in the liquid electrolyte which is greater than 2 to 4 mols per ℓ of the liquid electrolyte (Application at page 5, line 25-page 6, line 2). This feature allows the claimed invention to provide a good (e.g., high rate) discharge performance (Application at page 5, lines 9-24).

Further, the Application explains that the lithium concentration in the liquid electrolyte is an important feature of the claimed invention. Indeed, if the lithium salt concentration is too low, the lithium ion concentration is small and the diffusion rate is small (Application at page 6, lines 2-4).

Clearly, Hasegawa does not teach or suggest these novel features. Indeed, Hasegawa is directed to a completely different subject matter from the claimed invention. That is, Hasegawa is merely intended to provide a flame retardant solid electrolyte (Hasegawa at Abstract).

As noted above, Hasegawa attempts to accomplish this by providing mixing a polymer with a halogen or phosphorus containing compound (Hasegawa at col. 3, lines 17-32). In fact, nowhere does Hasegawa even discuss at least one purpose (e.g., to provide a good (e.g., high rate) discharge performance) to which the claimed invention is directed.

The Examiner attempts to rely on col. 9, lines 1-65 to support his allegations. However, this passage merely teaches that the liquid electrolyte has only a concentration of 0.5 to 2 moles/liter (Hasegawa at col. 9, lines 38-39). This is clearly less than the claimed range of lithium salt of greater than 2 to 4 moles/liter.

Indeed, as noted above, the Application explains that if the lithium salt concentration is too low, the lithium ion concentration is too low and the diffusion rate is small. Clearly, Hasegawa teaches a concentration which lower that the lithium salt concentration of the claimed invention. Therefore, it is clear that the Hasegawa device would not be able to provide the good (e.g., high rate) discharge performance provided by the claimed invention.

Therefore, Applicant submits that there are elements of the claimed invention that are not taught or suggested by Hasegawa. Therefore, the Examiner is respectfully requested to withdraw this rejection.

IV. FORMAL MATTERS AND CONCLUSION

In view of the foregoing, Applicant submits that claims 1-20, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

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The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

Date: _____

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